What is claimed is:

1. An optical wavelength division multiplexing network having a structure comprising at least two layers, a highest level network being a ring network which comprises at least one center node and two or more remote nodes which are joined by at least two optical fibers;

in the case where the layered structure comprises three or more layers, excepting the lowest level network the intermediate level network comprising a ring having said node belonging to the highest level network as its center node, nodes belonging to said ring network being joined by at least two optical fibers;

said lowest level network comprising a star network centered around an access node which multiplexes traffic from one or a plurality of optical network units (ONU), said ONU and said access node being directly joined by at least one optical fiber;

said remote nodes amplifying optical wavelength division multiplexing signals which are transmitted on an optical fiber comprising the higher level network which said remote nodes belong to, branching the signals to an optical fiber comprising the lower level network, and coupling optical wavelength division multiplexing signals, input from an optical fiber comprising the lower level network, to optical wavelength division multiplexing signals transmitted on an optical fiber comprising said higher level network, and amplifying the coupled signals;

said access node amplifying the optical wavelength division multiplexing signals transmitted from said optical fibers which comprise the higher level network which said access node is connected to, selecting optical signals having wavelengths which correspond to said ONU, and outputting the selected signals to said ONU; multiplexing said optical signals transmitted from said ONU, dividing the multiplexed signals in a plurality of directions, amplifying the divided signals, and transmitting the amplified signals to an optical fiber comprising a higher level network which said access node is connected to; and

the center node belonging to said highest level network and said ONU establishing a direct communication path by using lights of different wavelengths, the optical signals being amplified, branched, and routed at said remote nodes and said access node provided therebetween.

2. The optical wavelength division multiplexing network as described in Claim 1, wherein the highest level network and a network immediately therebelow comprise a double ring, a ring network immediately therebelow comprising one or a plurality of nodes, and a ring network therebelow comprising access nodes.

3. The optical wavelength division multiplexing network as described in Claim 2, the access nodes where the optical signals from said ONU are multiplexed transmitting and receiving optical wavelength division multiplexing signals to/from the higher level nodes by using an optical amplifier, an optical switch, and an optical multiplexer/de-multiplexer; communication between said center node belonging to said highest level network and said ONU being carried out by using optical amplifiers and passive optical components at a remote node provided higher level than said access nodes.

4. The optical wavelength division multiplexing network as described in Claim 3, said passive optical components at the remote node, which is provided higher level than said access nodes which multiplex optical signals from said ONU, comprising optical couplers.

5. The optical wavelength division multiplexing network as described in Claim 3, said passive optical components at the remote node, which is provided higher level than said access nodes which multiplex optical signals from said ONU, comprising optical circulators.

6. An optical wavelength division multiplexing network having a structure comprising at least two layers, a highest level network being a ring network which comprises at least one center node and two or more remote nodes which are joined by at least two optical fibers;

a lowest level network comprising a star network centered around an access node which multiplexes traffic from one or a plurality of optical network units (ONU), said ONU and said access node being directly joined by at least one optical fiber;

an immediately higher level network of said lowest level network being a ring network comprising at least one said access node connected by at least two fibers, traffic from said access nodes being multiplexed at a center node in the ring network which said access node belongs to, and connected by said center node to an even higher level network;

said remote node amplifying and branching optical wavelength division multiplexing signals which are transmitted on an optical fiber comprising the higher level network which said remote node belongs to, de-multiplexing and receiving only optical signals at wavelengths corresponding to said ONU, electrically processing said optical signals, and transmitting the processed signals at a predetermined wavelength to optical fibers comprising a lower level network; de-multiplexing and receiving only optical signals among the optical wavelength division multiplexing signals, input along the optical fibers comprising the lower level network, which are at wavelengths corresponding to said ONU, electrically processing said optical signals, converting the processed signals to optical signals at wavelengths which were allocated beforehand, and coupling the converted signals to optical wavelength division multiplexing signals transmitted on optical fibers comprising said higher level network;

said access node provided between said remote node and said ONU amplifying the optical wavelength division multiplexing signals which are transmitted on the optical fibers comprising the higher level network which the access node is connected to, selecting optical signals which correspond to said ONU and outputting the selected signals thereto; and multiplexing the optical signals from said ONU, dividing the multiplexed signal in a plurality of directions, amplifying the divided signals, and transmitting the amplified signals on optical fibers comprising the higher level network which said access node is connected to; and

optical signals having different wavelengths being transmitted between said ONU and the remote node in the higher level network, which is the center node in the ring network comprising said access node, said access node provided between said remote node and said ONU amplifying and routing the optical signals.

7. The optical wavelength division multiplexing network as described in Claim 6, wherein the highest level network and the network immediately therebelow comprise a double ring, and a ring network therebelow comprising access nodes.

8. The optical wavelength division multiplexing network as described in Claim 7, the access node, where optical signals from said ONU are multiplexed, transmitting and receiving optical wavelength division multiplexing signals to/from the remote node, where traffic from said access node is multiplexed, by using an optical amplifier, an optical switch, and an optical multiplexer/de-multiplexer;

said remote node equalizing, identifying, and reproducing optical wavelength division multiplexing signals at each wavelength from nodes belonging to said access nodes or higher level networks, converting the signals to optical signals at a predetermined wavelength and transmitting the converted signals to the higher level nodes or said access nodes; passive optical components being used for extracting optical wavelength division multiplexing signals from said higher level network and transmitting optical wavelength division multiplexing signals to said higher level network.

9. The optical wavelength division multiplexing network as described in Claim 8, said passive optical components at the remote node, which multiplexes traffic from said access nodes, uses optical couplers.

10. The optical wavelength division multiplexing network as described in Claim 8, said passive optical components at the remote node, which multiplexes traffic from said access nodes, uses optical circulators.

11. The optical wavelength division multiplexing network as described in Claim 2, wherein, at a node belonging to both the lower level ring network comprising said access nodes and the ring network thereabove, both ends of at least two looped optical fibers, which join the access nodes belonging to said lower level ring network, are open; and

said access nodes and said remote nodes do not comprise optical multiplexer/de-multiplexers having wavelength selectability, said ONU themselves having a wavelength de-multiplexing function.

12. The optical wavelength division multiplexing network as described in Claim 11, all the optical wavelength division multiplexing signals, transmitted on at least two optical fibers which are used in said ring networks, are bi-directional, bi-directional amplifiers being used in said remote nodes and said access nodes.

13. An optical wavelength division multiplexing network comprising at least three layers, a highest level network being a ring network comprising at least one center node and two or more remote nodes which are joined by at least four optical fibers;

an intermediate level network being a ring network having a node belonging to the higher level network as a center node thereof, access nodes belonging to said ring network being joined by at least four optical fibers;

a lowest level network comprising a star network centered around an access node which multiplexes traffic from optical network units (ONU), said ONU and said access node being directly joined by at least one optical fiber;

said remote node amplifying optical wavelength division multiplexing signals transmitted on said optical fibers comprising a higher level node which the remote node belongs to, branching the signals to optical fibers comprising a lower level network, and coupling optical wavelength division multiplexing signals which are input from optical fibers comprising the lower level network to optical wavelength division multiplexing signals transmitted on optical fibers comprising said higher level network, thereby amplifying the coupled signals;

said access node amplifying optical wavelength division multiplexing signals transmitted on optical fibers comprising a higher level network, which said access node belongs to, branching the amplified signals to a lower level network for outputting the branched signals to said ONU; multiplexing optical signals transmitted from said ONU, dividing the multiplexed signals in a plurality of directions, coupling the divided signal to optical wavelength division multiplexing signals transmitted on optical fibers comprising a higher level network which said access node is connected to, and amplifying the coupled signals; and

the center node belonging to said highest level network and said ONU establishing a direct communication path by using lights of different wavelengths, the optical signals

being amplified, branched, or routed, at said remote nodes and said access nodes provided therebetween.

14. The optical wavelength division multiplexing network as described in Claim 13, wherein, at a node belonging to said intermediate level ring network, both ends of at least four looped optical fibers, which join the access nodes belonging to said lower level ring network, are open; and

said access nodes and said remote nodes do not comprise optical multiplexer/de-multiplexers having wavelength selectability, said ONU themselves having a wavelength de-multiplexing function.

15. An optical wavelength division multiplexing network comprising at least three layers, a highest level network being a ring network comprising at least one center node and two or more remote nodes which are joined by at least two optical fibers;

an intermediate level network being a ring network having a node belonging to the higher level network as a center node thereof, access nodes belonging to said ring network being joined by at least four optical fibers;

a lowest level network comprising a star network centered around an access node which multiplexes traffic from optical network units (ONU), said ONU and said access node being directly joined by at least one optical fiber;

said remote nodes amplifying optical wavelength division multiplexing signals transmitted on said optical fibers comprising a higher level network which said remote nodes belong to, branching the signals to optical fibers comprising a lower level network, and coupling optical wavelength division multiplexing signals which are input from optical fibers comprising the lower level network to optical wavelength division multiplexing signals transmitted on optical fibers comprising said higher level network, and amplifying the coupled signals;

said access node amplifying optical wavelength division multiplexing signals transmitted on optical fibers comprising a higher level network, which said access node belongs to, branching them to a lower level network for outputting the branched signals to said ONU; multiplexing optical signals transmitted from said ONU, dividing them in a plurality of directions, coupling the divided signals to optical wavelength division

multiplexing signals transmitted on optical fibers comprising a higher level network which said access node is connected to, and amplifying the coupled signals; and

the center node belonging to said highest level network and said ONU establishing a direct communication path by using lights of different wavelengths, the optical signals being only amplified, branched, or routed, at said remote nodes and said access node provided therebetween.

16. The optical wavelength division multiplexing network as described in Claim 15, wherein, at a node belonging to said intermediate level ring network, one end of at least four looped optical fibers, which join the access nodes belonging to said lower level ring network, is open; and

said access nodes and said remote nodes do not comprise optical multiplexer/de-multiplexers having wavelength selectability, said ONU themselves having a wavelength de-multiplexing function.

17. An optical wavelength division multiplexing network having a structure comprising at least two layers,

a highest level network comprising a ring network having at least one center node and two or more remote nodes, which are joined by at least four optical fibers;

intermediate level networks excepting the lowest level network comprising a ring network having a node belonging to the higher level network as a center node, and at least one node belonging to the intermediate level ring networks being joined by at least four optical fibers;

the lowest level network comprising a star network centered around an access node belonging to the ring network which is provided immediately thereabove, said access node being joined to at least one optical network unit (ONU) by at least two optical fibers;

said remote nodes amplifying optical wavelength division multiplexing signals transmitted on said optical fibers comprising a higher level node which said remote nodes belong to, branching the signals to optical fibers comprising a lower level network; and coupling optical wavelength division multiplexing signals which are input from optical

fibers comprising the lower level network to optical wavelength division multiplexing signals transmitted on optical fibers comprising said higher level network;

said access node amplifying optical wavelength division multiplexing signals transmitted on optical fibers comprising a higher level network which said access node is connected to, branching the amplified signals to a lower level network, amplifying the divided signals, and outputting the amplified signals to said ONU; multiplexing and amplifying optical signals transmitted from said ONU, dividing the amplified signals in a plurality of directions, coupling the divided signals to optical wavelength division multiplexing signals transmitted on optical fibers comprising a higher level network which said access node is connected to, and amplifying the coupled signals; and

the center node belonging to said highest level network transmitting data by using different wavelengths allocated to said ONU, said ONU transmitting the data to said center node by using optical signals having the same wavelengths as the allocated wavelengths; and

said access nodes and said remote nodes provided between said center node and said ONU only amplifying and dividing, or routing, the optical signals.

18. The three-layered optical wavelength division multiplexing network as described in Claim 17, wherein the highest level network and the network therebelow comprise a double ring structure, and the nodes belonging to the lower level ring network comprise access nodes.

19. The optical wavelength division multiplexing network as described in Claim 18, one end of said lower level ring network are open at the remote node, which is the center node in said lower level ring network, belonging to said higher level ring network.

20. The optical wavelength division multiplexing network as described in Claim 19, said access node separating the optical wavelength division multiplexing signals at each wavelength, and distributing optical signals of different wavelengths to each of said ONU.

21. The optical wavelength division multiplexing network as described in Claim 19, said access node distributing optical signals to said ONU by using star couplers, said ONU having a wavelength selection function.

22. The optical wavelength division multiplexing network as described in one of Claims 1, 6, 13, 15, and 17, wherein communication between said ONU and said access nodes is doubled by using radio communications .

23. The optical wavelength division multiplexing network as described in one of Claims 1, 6, 13, 15, and 17, said optical multiplexer/de-multiplexer provided at said access node being provided at a remote terminal instead.

24. The optical wavelength division multiplexing network as described in Claim 23, wherein communication between said ONU and said access nodes is doubled by using radio communications.

25. A node apparatus in an optical network comprising at least two layers, the node apparatus, which is connected to a highest level network and becomes the final multiplexing destination of traffic, establishing a direct communication path to optical network units (ONU) and transmitting data by means of optical signals at wavelengths allocated to said ONU, said ONU transmitting data by means of optical signals at wavelengths which are different from said wavelength to the node apparatus which becomes the final multiplexing destination of traffic, and the node apparatus connecting to a lowest level network having wavelength selectability;

said node apparatus which becomes the final multiplexing destination of traffic comprising:

a plurality of optical de-multiplexers which de-multiplex optical wavelength division multiplexing signals, input from optical fibers comprising said highest level network, to optical signals at each wavelength;

a plurality of optical receivers which convert the optical signals which have been de-multiplexed by said optical de-multiplexers to electrical signals;

a plurality of selectors which selectively output either of the outputs from said plurality of optical receivers;

a signal termination section which performs predetermined electrical processing to the electrical signals which have been selected by said selectors, and outputs a plurality of groups of electrical signals;

a plurality of optical senders which convert the electrical signals output from the signal termination section to a plurality of optical signals having different wavelengths; and

a plurality of optical multiplexers which multiplex the optical signals output from said optical senders, and output the multiplexed signals to optical fibers comprising said highest level network.

26. A node apparatus in an optical network comprising at least two layers, the node apparatus, which is connected to a highest level network and becomes the final multiplexing destination of traffic, establishing a direct communication path to optical network units (ONU) and transmitting data by means of optical signals at wavelengths allocated to said ONU, said ONU transmitting data by means of optical signals at wavelengths which are different from said wavelength to the node apparatus which becomes the final multiplexing destination of traffic, and the node apparatus connecting to a lowest level network having wavelength selectability;

said node apparatus which becomes the final multiplexing destination of traffic comprising:

a plurality of optical de-multiplexers which de-multiplex optical wavelength division multiplexing signals, input from optical fibers comprising said highest level network, to optical signals at each wavelength;

a plurality of optical switches which select one of the optical signal which have been de-multiplexed by said optical de-multiplexers;

a plurality of optical receivers which convert the optical signals which have been selected by said optical switches to electrical signals;

a signal termination section which performs predetermined electrical processing to the electrical signals which have been output from said optical receivers, and outputs a plurality of groups of electrical signals;

a plurality of optical senders which convert the electrical signals output from the signal termination section to a plurality of optical signals having different wavelengths; and

a plurality of optical multiplexers which multiplex the optical signals output from said optical senders, and output the multiplexed signals to optical fibers comprising said highest level network.

27. A node apparatus in an optical network comprising at least two layers, the node apparatus, which is connected to a highest level network and becomes the final multiplexing destination of traffic, establishing a direct communication path to optical network units (ONU) and transmitting data by means of optical signals at wavelengths allocated to said ONU, said ONU transmitting data by means of optical signals at wavelengths which are different from said wavelength to the node apparatus which becomes the final multiplexing destination of traffic, and the node apparatus connecting to a lowest level network having wavelength selectability;

said node apparatus which becomes the final multiplexing destination of traffic comprising:

a plurality of optical de-multiplexers which de-multiplex optical wavelength division multiplexing signals, input from optical fibers comprising said highest level network, to a plurality of optical signals at each wavelength;

a plurality of optical switches which select one of the plurality of optical signals which have been de-multiplexed by said optical de-multiplexers;

a plurality of optical receivers which convert the optical signals which have been selected by said optical switches to electrical signals;

a signal termination section which performs predetermined electrical processing to the electrical signals which have been output from said optical receivers, and outputs a plurality of groups of electrical signals;

a plurality of optical senders which convert the plurality of electrical signals output from the signal termination section to a plurality of optical signals having different wavelengths;

a plurality of optical dividers which divide the optical signals output from said optical senders in a plurality of directions; and

a plurality of optical multiplexers which multiplex the plurality of optical signals output from said optical dividers, and output the multiplexed signals to optical fibers comprising said highest level network.

28. A node apparatus in an optical network comprising at least two layers, the node apparatus, which is connected to a highest level network and becomes the final multiplexing destination of traffic, establishing a direct communication path to optical network units (ONU) and transmitting data by means of optical signals at wavelengths allocated to said ONU, said ONU transmitting data by means of optical signals at wavelengths which are different from said wavelength to the node apparatus which becomes the final multiplexing destination of traffic, and the node apparatus connecting to a lowest level network having wavelength selectability;

the node apparatus being connected to networks other than said lowest level network, and comprising:

passive optical components which branch optical signals transmitted on an optical fiber comprising a higher level network to an optical fiber comprising a lower level network, and couple optical signals input from an optical fiber comprising said lower level network to optical signals transmitted on an optical fiber comprising said higher level network; and

optical amplifiers which amplify the optical signals input to said passive optical components and the optical signals output from said passive optical components.

29. A node apparatus in an optical network comprising at least two layers, the node apparatus, which is connected to a highest level network and becomes the final multiplexing destination of traffic, establishing a direct communication path to optical network units (ONU) and transmitting data by means of optical signals at wavelengths allocated to said ONU, said ONU transmitting data by means of optical signals at wavelengths which are different from said wavelength to the node apparatus which becomes the final multiplexing destination of traffic, the node apparatus being connected to said lowest level network, and comprising:

an optical switch which selects one of the optical signals which are input from optical fibers comprising a higher level network;

a first optical amplifier which amplifies, among the optical signals which are input from the optical fibers comprising said higher level network, at least the optical signal selected by said optical switch;

an optical multiplexer/de-multiplexer which, based on the optical signal selected by said optical switch, selects an optical signal having a wavelength which corresponds to said ONU, outputs the selected signal to said ONU, and multiplexes the optical signals transmitted from said ONU;

an optical divider which divides the optical signal, multiplexed by said optical multiplexer/de-multiplexer, into a plurality of directions, and transmits the divided signals to the optical fibers comprising said higher level network; and

a second optical amplifier which amplifies the optical signals which are transmitted to the optical fibers comprising said higher level network.

30. A node apparatus which is connected to a highest level network and becomes the final multiplexing destination of traffic in an optical network comprising at least two layers, the node apparatus connected to a network immediately above a lowest level network establishing a direct communication path with optical network units (ONU) and transmitting data by using optical signals at wavelengths allocated to each of said ONU, and said ONU transmitting the data to the node apparatus connected to a network provided higher level than said lowest level network by optical signals at wavelengths which are different to the wavelengths,

said node apparatus which is connected to said highest level network comprising:

a plurality of optical de-multiplexers which de-multiplex optical wavelength division multiplexing signals, input from optical fibers comprising said highest level network, to optical signals at each wavelength;

a plurality of optical receivers which convert the optical signals which have been de-multiplexed by said optical de-multiplexers to electrical signals;

a plurality of selectors which selectively output either of the outputs from said plurality of optical receivers;

a signal termination section which performs predetermined electrical processing to the electrical signals which have been selected by said selectors, and outputs a plurality of groups of electrical signals;

a plurality of optical senders which convert the electrical signals output from the signal termination section to a plurality of optical signals having different wavelengths; and

a plurality of optical multiplexers which multiplex the optical signals output from said optical senders, and output the multiplexed signals to optical fibers comprising said highest level network.

31. A node apparatus which is connected to a highest level network and becomes the final multiplexing destination of traffic in an optical network comprising at least two layers, the node apparatus connected to a network immediately above a lowest level network establishing a direct communication path with optical network units (ONU) and transmitting data by using optical signals at wavelengths allocated to each of said ONU, and said ONU transmitting the data to the node apparatus connected to a network provided higher level than said lowest level network by optical signals at wavelengths which are different to the wavelengths,

said node apparatus which is connected to said highest level network comprising:

a plurality of optical de-multiplexers which de-multiplex optical wavelength division multiplexing signals, input from optical fibers comprising said highest level network, to optical signals at each wavelength;

a plurality of optical switches which select one of the optical signal which have been de-multiplexed by said optical de-multiplexers;

a plurality of optical receivers which convert the optical signals which have been selected by said optical switches to electrical signals;

a signal termination section which performs predetermined electrical processing to the electrical signals which have been output from said optical receivers, and outputs a plurality of groups of electrical signals;

a plurality of optical senders which convert the electrical signals output from the signal termination section to a plurality of optical signals having different wavelengths; and

a plurality of optical multiplexers which multiplex the optical signals output from said optical senders, and output the multiplexed signals to optical fibers comprising said highest level network.

32. A node apparatus which is connected to a highest level network and becomes the final multiplexing destination of traffic in an optical network comprising at least two layers, the node apparatus connected to a network immediately above a lowest level network establishing a direct communication path with optical network units (ONU) and transmitting data by using optical signals at wavelengths allocated to each of said ONU, and said ONU transmitting the data to the node apparatus connected to a network provided higher level than said lowest level network by optical signals at wavelengths which are different to the wavelengths,

said node apparatus which is connected to said highest level network comprising:

a plurality of optical de-multiplexers which de-multiplex optical wavelength division multiplexing signals, input from optical fibers comprising said highest level network, to a plurality of optical signals at each wavelength;

a plurality of optical switches which select one of the plurality of optical signals which have been de-multiplexed by said optical de-multiplexers;

a plurality of optical receivers which convert the optical signals which have been selected by said optical switches to electrical signals;

a signal termination section which performs predetermined electrical processing to the electrical signals which have been output from said optical receivers, and outputs a plurality of groups of electrical signals;

a plurality of optical senders which convert the plurality of electrical signals output from the signal termination section to a plurality of optical signals having different wavelengths;

a plurality of optical dividers which divide the optical signals output from said optical senders in a plurality of directions; and

a plurality of optical multiplexers which multiplex the plurality of optical signals output from said optical dividers, and output the multiplexed signals to optical fibers comprising said highest level network.

33. A node apparatus in an optical network comprising at least two layers, the node apparatus connected to a network immediately above a lowest level network establishing a direct communication path with optical network units (ONU) and transmitting data by

using optical signals at wavelengths allocated to each of said ONU, and said ONU transmitting the data to the node apparatus connected to a network provided higher level than said lowest level network by optical signals at wavelengths which are different to the wavelengths, the node apparatus being connected to a network which is provided higher level than said lowest level network, and comprising:

passive optical components which branch optical signals transmitted on optical fibers comprising the higher level network, and couple input optical signals to optical signals transmitted on optical fibers comprising said higher level network;

optical amplifiers which amplify the optical signals input to said passive optical components and the optical signals output from said passive optical components; and

an equipment for signal termination which de-multiplexes only the optical signals among those divided by said passive optical components at wavelengths corresponding to said ONU, receives and electrically processes the optical signals at each wavelength, and transmits the processed signals at a predetermined wavelength, and in addition, de-multiplexes only the optical signals among those input along the optical fibers comprising a lower level network which are at wavelengths corresponding to said ONU, receives and electrically processes the optical signals at each wavelength, converts the processed signals to optical signals at a wavelength allocated beforehand, and transmits the converted signals to said passive optical components.

34. A node apparatus in an optical network comprising at least two layers, the node apparatus connected to a network immediately above a lowest level network establishing a direct communication path with optical network units (ONU) and transmitting data by using optical signals at wavelengths allocated to each of said ONU, and said ONU transmitting the data to the node apparatus connected to a network provided higher level than said lowest level network by optical signals at wavelengths which are different to the wavelengths, the node apparatus being connected to said lowest level network, and comprising:

an optical switch which selects one of the optical signals which are input from optical fibers comprising a higher level network;

a first optical amplifier which amplifies, among the optical signals which are input from the optical fibers comprising said higher level network, at least the optical signal selected by said optical switch;

an optical multiplexer/de-multiplexer which, based on the optical signal selected by said optical switch, selects an optical signal having a wavelength which corresponds to said ONU, outputs the selected signal to said ONU, and multiplexes the optical signals transmitted from said ONU;

an optical divider which divides the optical signal, multiplexed by said optical multiplexer/de-multiplexer, into a plurality of directions, and transmits the divided signals to the optical fibers comprising said higher level network; and

a second optical amplifier which amplifies the optical signals which are transmitted to the optical fibers comprising said higher level network.

35. A node apparatus in an optical network comprising three layers, the node apparatus, which is connected to a highest level network and becomes the final multiplexing destination of traffic, establishing a direct communication path to optical network units (ONU) and transmitting data by using optical signals at wavelengths allocated to said ONU, said ONU transmitting data by using optical signals at wavelengths which are different from said wavelengths to said node apparatus which becomes the final multiplexing destination of traffic, nodes apparatuses other than said node apparatus which becomes the final multiplexing destination of traffic not having the ability to select wavelengths, and said ONU having a function for de-multiplexing wavelengths, said node apparatus which becomes the final multiplexing destination of traffic comprising:

a plurality of optical de-multiplexers which de-multiplex optical wavelength division multiplexing signals, input from optical fibers comprising said highest level network, to optical signals at each wavelength;

a plurality of optical receivers which convert the optical signals which have been de-multiplexed by said optical de-multiplexers to electrical signals;

a plurality of selectors which selectively output either of the outputs from said plurality of optical receivers;

a signal termination section which performs predetermined electrical processing to the electrical signals which have been selected by said selectors, and outputs a plurality of groups of electrical signals;

a plurality of optical senders which convert the electrical signals output from the signal termination section to a plurality of optical signals having different wavelengths; and

a plurality of optical multiplexers which multiplex the optical signals output from said optical senders, and output the multiplexed signals to optical fibers comprising said highest level network.

36. A node apparatus in an optical network comprising three layers, the node apparatus, which is connected to a highest level network and becomes the final multiplexing destination of traffic, establishing a direct communication path to optical network units (ONU) and transmitting data by using optical signals at wavelengths allocated to said ONU, said ONU transmitting data by using optical signals at wavelengths which are different from said wavelengths to said node apparatus which becomes the final multiplexing destination of traffic, nodes apparatuses other than said node apparatus which becomes the final multiplexing destination of traffic not having the ability to select wavelengths, and said ONU having a function for de-multiplexing wavelengths,

the node apparatus being connected to networks other than said lowest level network, and comprising:

passive optical components which branch optical signals transmitted on optical fibers comprising a higher level network to optical fibers comprising a lower level network, and in addition, couple optical signals input from optical fibers comprising said lower level network to optical signals transmitted on optical fibers comprising said higher level network; and

optical amplifiers which amplify optical signals which are input to, and output from, said passive optical components;

wherein both ends of the loop of optical fibers comprising said lower level network are opened by using optical terminators.

37. A node apparatus in an optical network comprising three layers, the node apparatus, which is connected to a highest level network and becomes the final multiplexing destination of traffic, establishing a direct communication path to optical network units (ONU) and transmitting data by using optical signals at wavelengths allocated to said ONU, said ONU transmitting data by using optical signals at wavelengths which are different from said wavelengths to said node apparatus which becomes the final multiplexing destination of traffic, nodes apparatuses other than said node apparatus which becomes the final multiplexing destination of traffic not having the ability to select wavelengths, and said ONU having a function for de-multiplexing wavelengths, the node apparatus being connected to a lowest level network, and comprising:

first passive optical components which branch optical signals transmitted on optical fibers comprising a higher level network to a lower level network;

an optical switch which selects one of the optical signals which have been branched by said first passive optical components;

an optical multiplexer/de-multiplexer which transmits the optical signals selected by said optical switch toward said ONU, and multiplexes the optical signals transmitted from said ONU;

an optical divider which divides the optical signals multiplexed by said optical multiplexer/de-multiplexer in a plurality of directions;

second passive optical components which couple optical signals divided by said optical divider to optical signals transmitted on optical fibers comprising said higher level network; and

optical amplifiers which amplify the optical signals which are input to and output from said first and second passive optical components.

38. A node apparatus in an optical network comprising three layers, the node apparatus, which is connected to a highest level network and becomes the final multiplexing destination of traffic, establishing a direct communication path to optical network units (ONU) and transmitting data by using optical signals at wavelengths allocated to said ONU, said ONU transmitting data by using optical signals at wavelengths which are different from said wavelengths to said node apparatus which

becomes the final multiplexing destination of traffic, nodes apparatuses other than said node apparatus which becomes the final multiplexing destination of traffic not having the ability to select wavelengths, and said ONU having a function for de-multiplexing wavelengths, the node apparatus being connected to networks other than a lowest level network, and comprising:

passive optical components which branch optical signals transmitted on optical fibers comprising a higher level network to optical fibers comprising a lower level network, and in addition, couple optical signals input from optical fibers comprising said lower level network to optical signals transmitted on optical fibers comprising said higher level network; and

optical amplifiers which amplify optical signals transmitted on the optical fibers comprising said higher level network;

wherein one end of the loop of optical fibers comprising said lower level network is opened by using optical terminators.

39. A node apparatus in an optical network comprising at least two layers, the node apparatus, which is connected to a highest level network and becomes the final multiplexing destination of traffic, establishing a direct communication path to optical network units (ONU) and transmitting data by using optical signals at wavelengths allocated to said ONU, said ONU transmitting data by using optical signals at same wavelengths as said wavelengths to said node apparatus which becomes the final multiplexing destination of traffic, said node apparatus which becomes the final multiplexing destination of traffic comprising:

a plurality of optical de-multiplexers which de-multiplex optical wavelength division multiplexing signals, input from optical fibers comprising said highest level network, to optical signals at each wavelength;

a plurality of optical receivers which convert the optical signals which have been de-multiplexed by said optical de-multiplexers to electrical signals;

a plurality of selectors which selectively output either of the outputs from said plurality of optical receivers;

a signal termination section which performs predetermined electrical processing to the electrical signals which have been selected by said selectors, and outputs a plurality of groups of electrical signals;

a plurality of optical senders which convert the electrical signals output from the signal termination section to a plurality of optical signals having different wavelengths; and

a plurality of optical multiplexers which multiplex the optical signals output from said optical senders, and output the multiplexed signals to optical fibers comprising said highest level network.

40. A node apparatus in an optical network comprising at least two layers, the node apparatus, which is connected to a highest level network and becomes the final multiplexing destination of traffic, establishing a direct communication path to optical network units (ONU) and transmitting data by using optical signals at wavelengths allocated to said ONU, said ONU transmitting data by using optical signals at same wavelengths as said wavelengths to said node apparatus which becomes the final multiplexing destination of traffic, the node apparatus being connected to networks other than said lowest level network, and comprising:

first passive optical components which branch optical signals transmitted on optical fibers comprising a higher level network to optical fibers comprising a lower level network;

second passive optical components which couple optical signals input from optical fibers comprising said lower level network to optical signals transmitted on optical fibers comprising said higher level network; and

optical amplifiers which amplify optical signals which are input to, and output from, said first and second passive optical components;

wherein both ends of the loop of optical fibers comprising said lower level network are opened by using optical terminators.

41. A node apparatus in an optical network comprising at least two layers, the node apparatus, which is connected to a highest level network and becomes the final multiplexing destination of traffic, establishing a direct communication path to optical

network units (ONU) and transmitting data by using optical signals at wavelengths allocated to said ONU, said ONU transmitting data by using optical signals at same wavelengths as said wavelengths to said node apparatus which becomes the final multiplexing destination of traffic, the node apparatus being connected to said lowest level network, and comprising:

first passive optical components which branch optical signals transmitted on optical fibers comprising a higher level network to a lower level network;

an optical switch which selects one of the optical signals which have been branched by said first passive optical components;

a first optical amplifier which amplifies, among the optical signals which have been branched by said first passive optical components, at least the optical signal selected by said optical switch;

a second passive optical component which distributes the optical signals amplified by said first optical amplifier to said ONU, and multiplexes the optical signals transmitted from said ONU;

a second optical amplifier which amplifies the optical signals multiplexed by said second passive optical component;

an optical divider which divides the optical signal, amplified by said second optical amplifier, into a plurality of directions;

a third passive optical component which couples the optical signals branched by said optical divider to an optical signal transmitted on optical fibers comprising said higher level network; and

a third optical amplifier which amplifies the optical signals which are transmitted on the optical fibers comprising said higher level network.

42. A system switching method in an optical wavelength division multiplexing network having a structure comprising at least two layers, a highest level network being a ring network which comprises at least one center node and two or more remote nodes which are joined by at least two optical fibers;

in the case where the layered structure comprises three or more layers, excepting the lowest level network the intermediate level network comprising a ring having said

node belonging to the highest level network as its center node, nodes belonging to said ring network being joined by at least two optical fibers;

said lowest level network comprising a star network centered around an access node which multiplexes traffic from one or a plurality of optical network units (ONU), said ONU and said access node being directly joined by at least one optical fiber;

the center node belonging to said highest level network and said ONU establishing a direct communication path by using lights of different wavelengths, the optical signals being amplified, branched, and routed at said remote nodes and said access node provided therebetween; the system switching method comprising the following steps:

when an optical fiber (working fiber), which is being used in transmitting a down signal from said center node to said ONU in said higher level network, becomes severed, an access node belonging to a remote node provided downstream than the severance point as seen from said center node, switches from the working fiber side to an optical fiber side (protection fiber) which is not presently in use, said down signal being received after transmission along said protection fiber;

when a working fiber for transmitting an up signal from said ONU to said center node in said higher level network has become severed, for an access node belonging to remote node where the severance point on the working fiber to said center node is located, said center node switches from the working fiber to a protection fiber, and receives the up signal from said protection fiber; and

when an optical cable in said intermediate level network has become severed, an access node, among the access nodes connected to said intermediate level network, which is provided downstream than the severance point for the optical signal transmitted on the severed fiber switches from the working fiber to the protection fiber and thereby receives said down signal; and at said access node provided downstream, said center node switches from the working fiber to the protection fiber and thereby receives said up signal from said protection fiber.

43. A system switching method in an optical wavelength division multiplexing network comprising at least three layers, a highest level network being a ring network comprising at least one center node and two or more remote nodes which are joined by at least four optical fibers;

an intermediate level network being a ring network having a node belonging to the higher level network as a center node thereof, access nodes belonging to said ring network being joined by at least four optical fibers;

a lowest level network comprising a star network centered around an access node which multiplexes traffic from optical network units (ONU), said ONU and said access node being directly joined by at least one optical fiber;

the center node belonging to said highest level network and said ONU establishing a direct communication path by using lights of different wavelengths, the optical signals being amplified, branched, or routed at said remote nodes and said access nodes provided therebetween; the system switching method comprising the following steps:

when an optical fiber (working fiber), which is being used in transmitting a down signal from said center node to said ONU in said higher level network, becomes severed, an access node belonging to a remote node provided downstream than the severance point as seen from said center node, switches from the working fiber side to an optical fiber side (protection fiber) which is not presently in use, said down signal being received after transmission along said protection fiber;

when a working fiber for transmitting an up signal from said ONU to said center node in said higher level network has become severed, for an access node belonging to remote node where the severance point on the working fiber to said center node is located, said center node switches from the working fiber to a protection fiber and receives the up signal from said protection fiber; and

when an optical cable in said intermediate level network has become severed, an access node, among the access nodes connected to said intermediate level network, which is provided downstream than the severance point for the optical signal transmitted on the severed fiber switches from the working fiber to the protection fiber and thereby receives said down signal; and at said access node provided downstream, said center node switches from the working fiber to the protection fiber and thereby receives said up signal from said protection fiber.

44. A system switching method in an optical wavelength division multiplexing network comprising at least three layers, a highest level network being a ring network

comprising at least one center node and two or more remote nodes which are joined by at least two optical fibers;

an intermediate level network being a ring network having a node belonging to the higher level network as a center node thereof, access nodes belonging to said ring network being joined by at least four optical fibers;

a lowest level network comprising a star network centered around an access node which multiplexes traffic from optical network units (ONU), said ONU and said access node being directly joined by at least one optical fiber;

the center node belonging to said highest level network and said ONU establishing a direct communication path by using lights of different wavelengths, the optical signals being only amplified, branched, and routed at said remote nodes and said access node provided therebetween; the system switching method comprising the following steps:

when an optical fiber (working fiber), which is being used in transmitting a down signal from said center node to said ONU in said higher level network, becomes severed, an access node belonging to a remote node provided downstream than the severance point as seen from said center node, switches from the working fiber side to an optical fiber (protection fiber) which is not presently in use, said down signal being received after transmission along said protection fiber;

when a working fiber for transmitting an up signal from said ONU to said center node in said higher level network has become severed, for an access node belonging to remote node where the severance point on the working fiber to said center node is located, said center node switches from the working fiber to a protection fiber, and receives the up signal from said protection fiber; and

when an optical cable in said intermediate level network has become severed, an access node, among the access nodes connected to said intermediate level network, which is provided downstream than the severance point for the optical signal transmitted on the severed fiber switches from the working fiber to the protection fiber and thereby receives said down signal; and at said access node provided downstream, said center node switches from the working fiber to the protection fiber and thereby receives said up signal from said protection fiber.

45. A system switching method in an optical wavelength division multiplexing network having a structure comprising at least two layers,

a highest level network comprising a ring network having at least one center node and two or more remote nodes, which are joined by at least four optical fibers;

intermediate level networks excepting the lowest level network comprising a ring network having a node belonging to the higher level network as a center node, and at least one node belonging to the intermediate level ring networks being joined by at least four optical fibers;

the lowest level network comprising a star network centered around an access node belonging to the ring network which is provided immediately thereabove, said access node being joined to at least one optical network unit (ONU) by at least two optical fibers;

the center node belonging to said highest level network transmitting data by using different wavelengths allocated to said ONU, said ONU transmitting the data to said center node by using optical signals having the same wavelengths as the allocated wavelengths; and

said access nodes and said remote nodes provided between said center node and said ONU only amplifying and dividing, or routing, the optical signals, the system switching method comprising the following steps:

when an optical fiber (working fiber), which is being used in transmitting a down signal from said center node to said ONU in said higher level network, becomes severed, an access node belonging to a remote node provided downstream than the severance point as seen from said center node, switches from the working fiber side to an optical fiber (protection fiber) which is not presently in use, said down signal being received after transmission along said protection fiber;

when a working fiber for transmitting an up signal from said ONU to said center node in said higher level network has become severed, for an access node belonging to remote node where the severance point on the working fiber to said center node is located, said center node switches from the working fiber to a protection fiber, and receives the up signal from said protection fiber; and

when an optical cable in said intermediate level network has become severed, an access node, among the access nodes connected to said intermediate level network, which

is provided downstream than the severance point for the optical signal transmitted on the severed fiber switches from the working fiber to the protection fiber and thereby receives said down signal; and at said access node provided downstream, said center node switches from the working fiber to the protection fiber and thereby receives said up signal from said protection fiber.